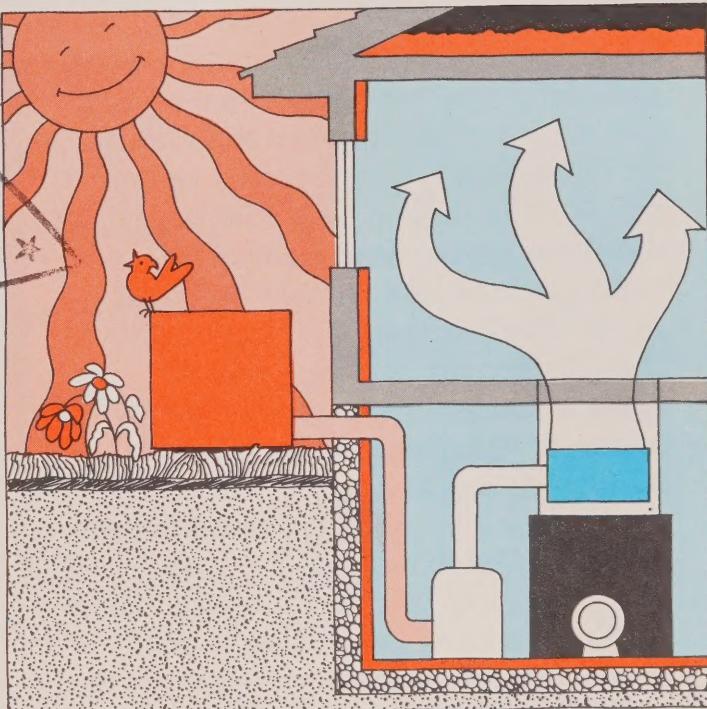
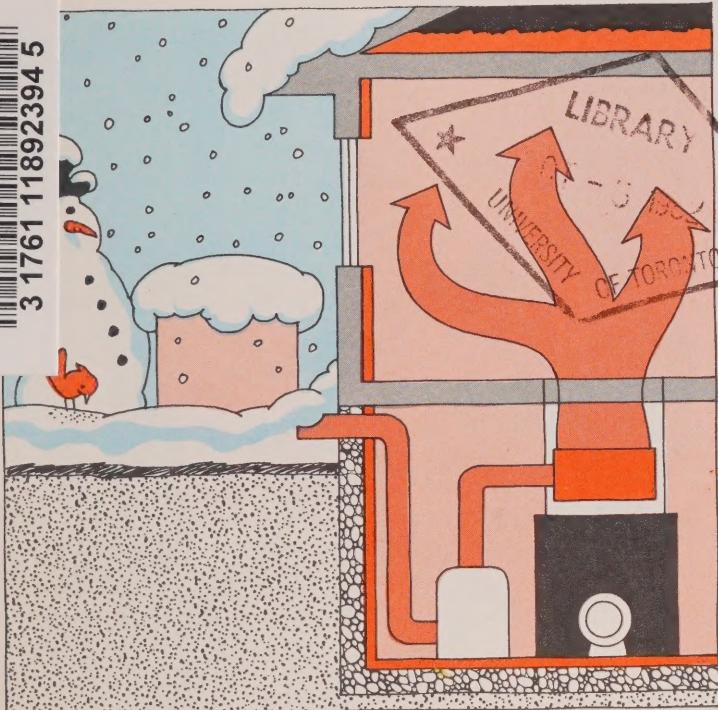


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## THE "HEAT" PUMP



The most efficient heating system for all seasons.

# Heat Talk...

Home heating has become such a major and ever-increasing expense that a homeowner can't afford to spend extra dollars on an inefficient heating system or on rapidly rising fuel oil costs. (See page 10 for details on how to keep the heat in.)

If you now heat with oil, or if your present heating system is beginning to show its age, the time has come to consider converting to another energy source or replacing your system with a more efficient one.

Ontario Hydro's recent research has demonstrated that one of the most energy-efficient systems for central home heating is a HEAT PUMP. This booklet was developed to explain the features of a HEAT PUMP system and to help homeowners make informed energy choices for the future.

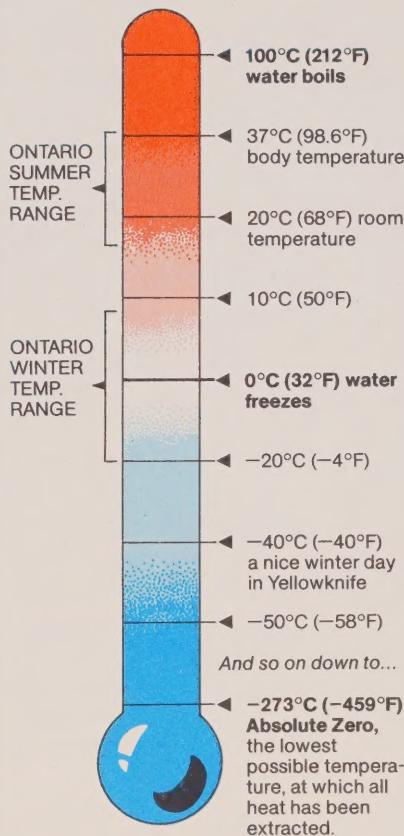


# What is a Heat Pump?

A heat pump is an electrically-operated device that provides warmth for your home by extracting heat from the outside air and moving it into the home, rather than by creating heat itself. Since it only moves energy, a heat pump can provide more heat energy than the electrical energy used to operate it.

How can you extract heat from cold outside air?

Every day, even in midwinter, the earth's atmosphere soaks up an enormous amount of energy from the sun. Most people find it hard to believe that there is substantial heat available from air that feels so cold. But temperature and heat, although they are related, are not the same thing. It is possible for air to be at a low temperature and still contain plenty of heat. Let's take a look at a temperature scale:



As heat is removed from air, the air temperature falls. If all the heat could be completely removed, the air temperature would fall to  $-273^{\circ}\text{C}$  ( $-459^{\circ}\text{F}$ ). This temperature is called "Absolute Zero". On a cold winter day in Ontario, when the air temperature has dropped to  $-20^{\circ}\text{C}$  ( $-4^{\circ}\text{F}$ ), it is still far above absolute zero and it still contains large amounts of heat. A heat pump is designed to extract this available heat from the cold air and move it into the home.

**A Heat Pump is not a new idea**

Every house has at least one heat pump right now — the kitchen refrigerator.

Place your hand near the coils behind or underneath the refrigerator when it is running. The warmth you feel is the heat that is being extracted from the cold interior compartment and moved to the outside.

# Operation of a Heat Pump...

To appreciate how a heat pump works, you need to understand three basic principles:

**1. Heat always moves from an area of high temperature to an area of low temperature.**

If you hold the metal handle of a pan as it heats up on the stove, the heat gradually moves up the handle and into your hand.

**2. For a liquid to evaporate or vapourize, it must absorb heat.**

After a shower, you will feel quite cool if you "drip-dry" because your body heat is being absorbed as the water on your skin turns into a vapour.

**3. For a liquid vapour to condense, it must release heat.**

As steam from a boiling kettle gives off its heat, it condenses back to the liquid state.

## Steps in the Cycle

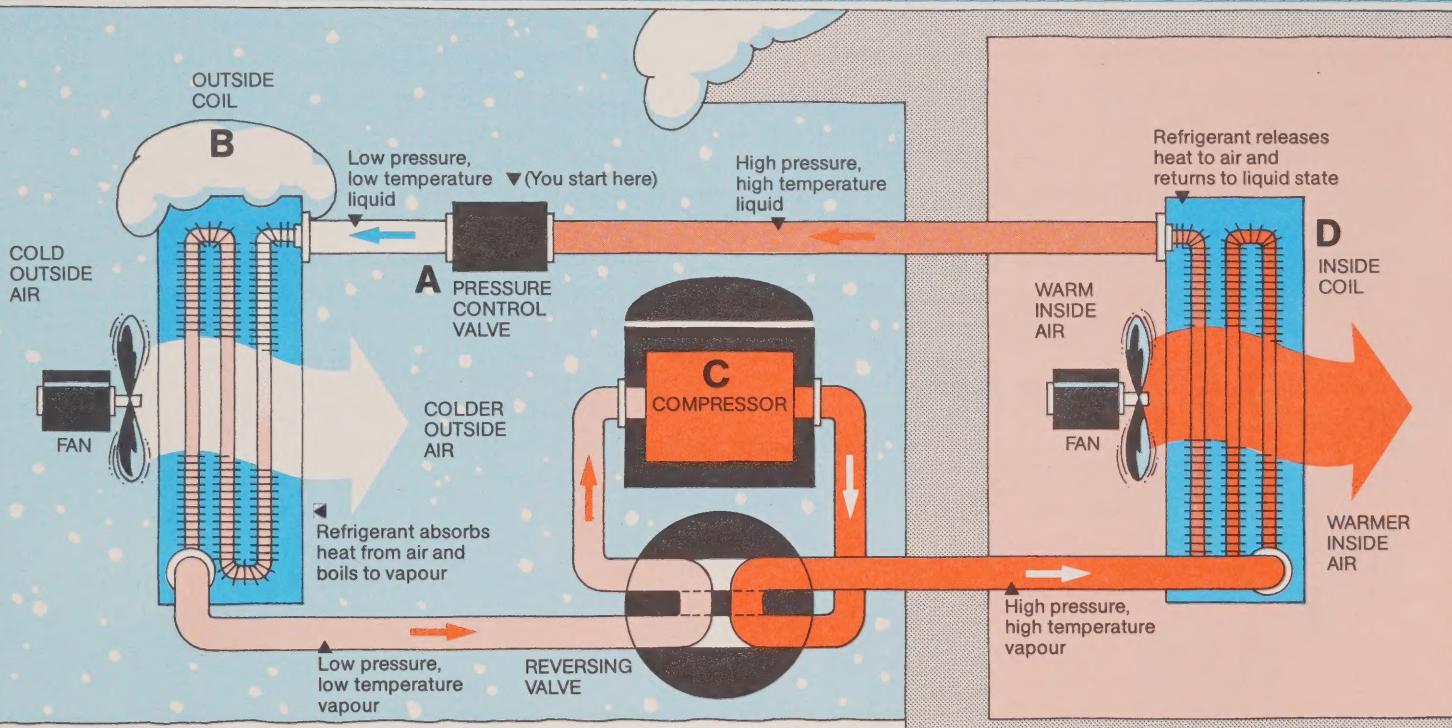
In a heat pump, a liquid refrigerant circulating through a closed loop system is used to collect, transport and release heat energy.

As this liquid passes through a pressure control valve ("A" on diagram), its pressure and temperature are rapidly lowered until it becomes colder than the outside air. When a fan blows outdoor air across the coil ("B"), the heat available in the air will be absorbed by the refrigerant, causing it to vapourize (principles 1 and 2).

The refrigerant vapour is then pumped through the compressor ("C") where its pressure and temperature are raised until it becomes warmer than the inside air. Air blowing across the inside coil ("D") removes the heat from the hot refrigerant vapour (principle 1), then forces it into the duct system to heat the house.

As the refrigerant vapour gives up its heat, it condenses back to a liquid (principle 3) and the cycle begins again as the liquid refrigerant is pumped outside.

# in the Heating Cycle...



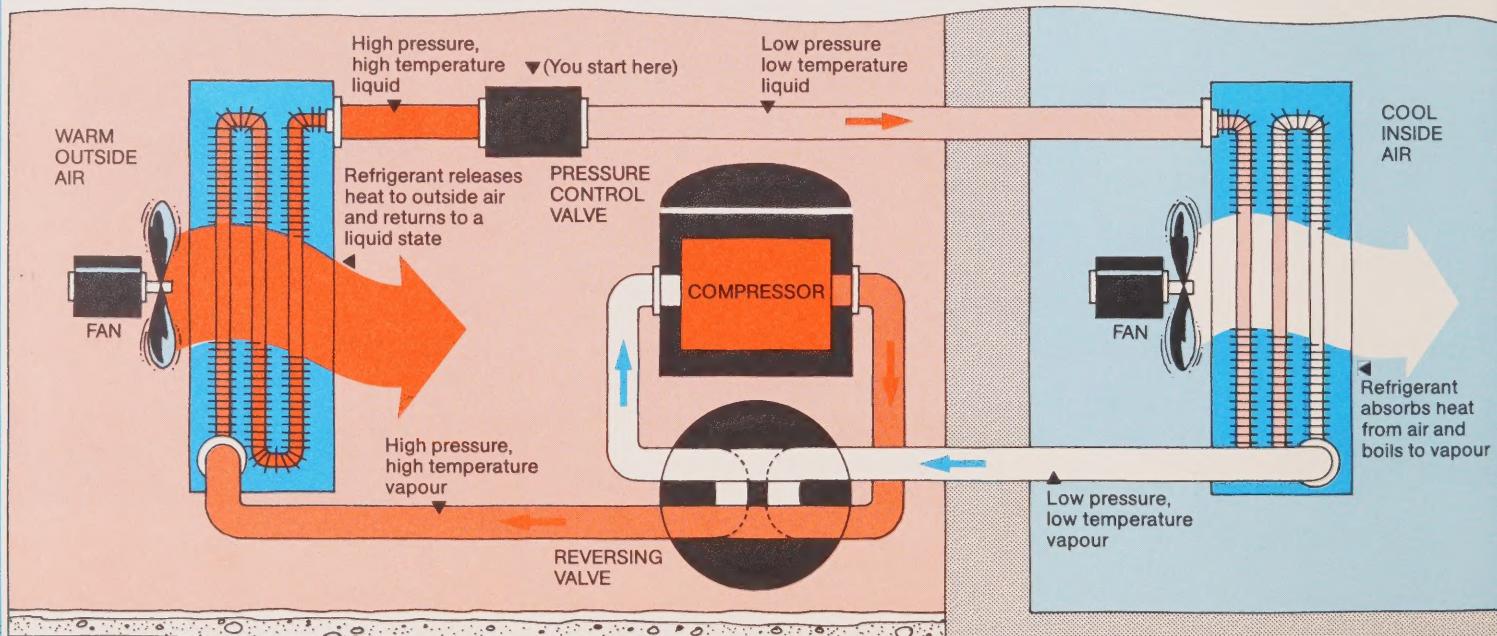
# ...in the Cooling Cycle.

## A Remarkable Bonus

A major advantage of a heat pump is its ability to reverse the direction in which heat is moved. In the summer, the system becomes a central air conditioner by reversing its operation to extract heat from the inside air and move it to the outside air. Thus, the heat pump can provide even, comfortable temperatures in your home all year round.

## An Important Note

All homes with air conditioning systems are subject to increased property tax assessment to reflect the increase in value derived from central cooling. Consequently, homes with heat pumps will incur an extra \$30-\$60 in property taxes (subject to local adjustments) over homes without air conditioning.



# The "Add-on" Heat Pump

## A good marriage for your home

The efficiency of a heat pump decreases as the outside temperature drops. The colder it gets, the harder it becomes to absorb heat out of the air.

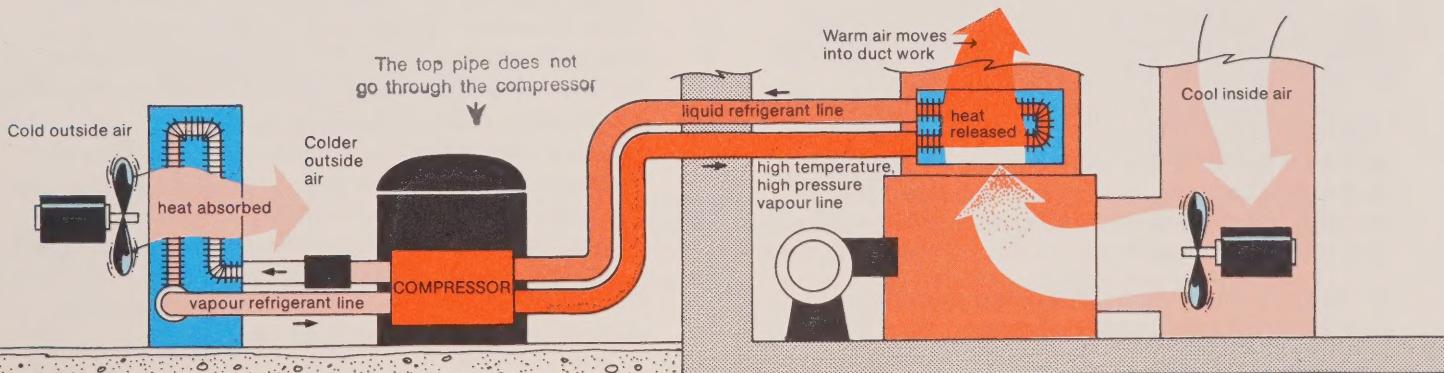
The outside air temperature at which the heat pump can no longer replace all the heat that the home is losing is called the "BALANCE POINT". Usually, this point occurs between  $-4^{\circ}$  to  $+1^{\circ}\text{C}$  ( $25^{\circ}$  to  $35^{\circ}\text{F}$ ).

Since it is inevitable that some days will fall below this balance point every winter, it is necessary that a house have a supplementary source of heat to maintain inside temperatures when the heat pump cannot handle the heating load by itself.

The nice thing about adding a heat pump to an existing oil or gas furnace is that it permits each system to work in the temperature range where it is most efficient. Also, the add-on heat pump provides the bonus of efficient summer cooling.

You could contact your local weather bureau to find out how many days the air temperature is above the balance point and, therefore, how many days the heat pump alone would be sufficient to heat your home.

If supplementary heat is provided by electricity, as in an all-electric heat pump system, then the two systems will work together to heat the home; if gas or oil heating is used, the heat pump will automatically turn off before the auxiliary heat operates.



# Efficiency and Economy

Recent factors that have focused attention on heat pumps

## 1. A heat pump can save you up to 50% in fuel bills

Keep in mind that *total heating energy requirements* are reduced when a heat pump is added to an existing heating system, regardless of the fuel used. However, the *cost of heating* is not necessarily reduced to the same extent.

**NOTE: Detailed comparisons of the cost of heating with various types of heating systems cannot be included here because of the enormous differences among individual homes. No two houses or family lifestyles are alike. Location, exposure, house design, insulation, temperature settings, type of fuel and its availability are all factors that contribute to the cost of home heating.**

The main concern for a homeowner is the amount of heat obtained for each dollar spent. The efficiency of a home heating system is measured by the number of units of heat energy output obtained for each unit of energy input. The measure of efficiency of a heat pump is called the Coefficient of Performance, (C.O.P.).

Heat pumps alone can return more energy than they consume. *Unlike natural gas, fuel oil, or electric resistance systems, a heat pump does not consume energy to create heat. It uses electrical energy to collect and transfer heat that is already available in the surrounding environment. A heat pump uses energy only to run the fan and the compressor.* (see chart)

## 2. Federal Government Off-Oil Incentive Program

In order to reduce Canada's oil consumption, the federal

government has introduced the Canada Oil Substitution Program (COSP). This program provides a taxable grant to aid homeowners with the costs of converting from fuel oil as the primary fuel for domestic space heating. The taxable grant will cover up to 50% of eligible costs, to a maximum of \$800. Heat pumps that reduce oil consumption by at least 50% qualify for this grant. Contact your local Hydro for more details on COSP.

## 3. New standards for air-to-air heat pump installation

The Canadian Standards Association Publication C273.5M has been developed to standardize the installation requirements for all residential air-to-air heat pumps.

C.S.A. Standard C273.5M sets out the requirements for system design, installation, service, warranty information and customer education. Form A, part of the C.S.A. Standard C273.5M, assures the homeowner, by means of a start up check, that the heat pump system has been properly installed and satisfies all specifications.

## 4. Spiralling costs of conventional fuels

Electrical heating is already comparable in cost to oil heating in Ontario. As the price of natural gas continues to escalate, electricity will likely become the most economical way to heat a home, sometime in the mid 1980's.

A heat pump uses only reliable electrical power and the continual heat of the sun to provide economical, efficient heating and cooling for your home.

# Comparison of heating systems



Type of System	Total Energy Input	Useable Energy Output
Electrically operated heat pump	1 unit of energy	1 to 3 units of heat energy — depending on the outside temperature
Electrical resistance	1 unit of energy	1 unit of heat energy
Natural gas	1 unit of energy	*Approx. 3/5 of a unit of heat energy
Fuel oil	1 unit of energy	*Approx. 2/3 of a unit of heat energy
Coal or wood fireplace or furnace		There is a renewed interest in these methods of home heating. Their efficiencies can range from a gain of approximately 1/2 a unit to a net loss. A poorly designed fireplace can actually draw more heat out of the house than it puts in, through the draft it creates.
Solar, wind		Active and Passive Solar designs are promising. Active systems could provide all the heating requirements of a house in our climate, but the costs at this time are prohibitive. Passive systems can presently provide up to 70% of a home's heating requirements when combined with improved insulation and air tightness.

\*Approximately 2/5 to 1/3 of the energy in gas and oil goes up the chimney and is not available to heat your home.

\*These figures taken from: HUDAC/ Ministry of Energy Publication: *Builder's Guide to Energy Efficiency in New Housing*, January 1980.

# Insulation

## An essential requirement

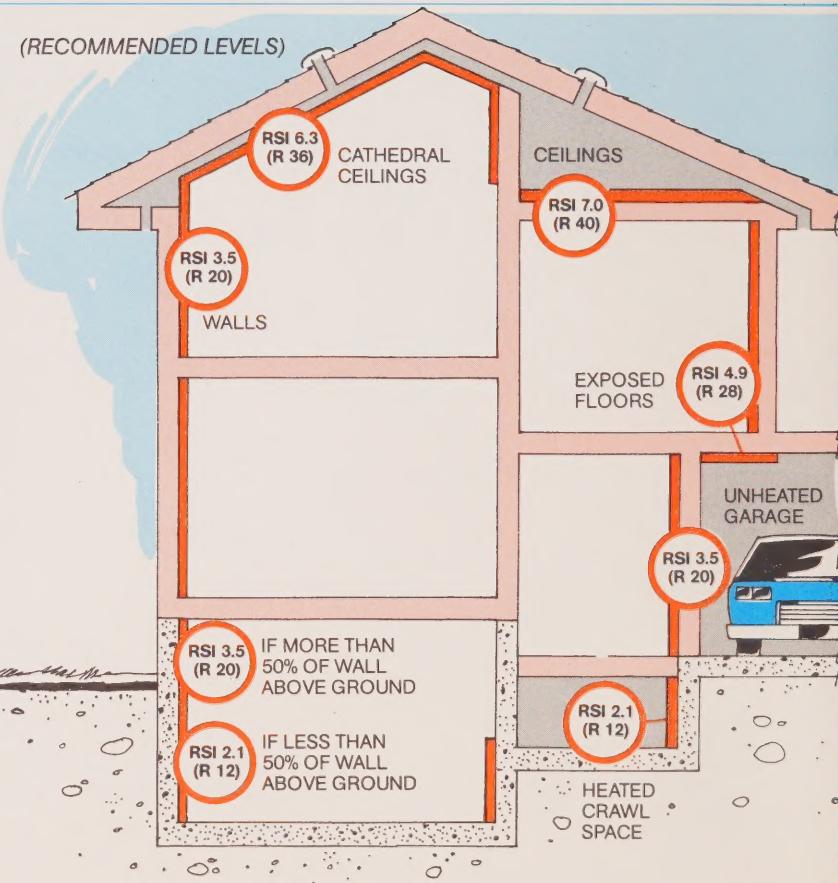
No matter what type of heating system you presently have, if your house is like most, you are probably spending some money warming up the great outdoors.

It is pointless to spend a few thousand dollars on a heat pump system and then throw away the money saved on fuel because of inadequate insulation or cracks around doors and windows.

Insulation keeps the heat inside during the winter and outside during the summer. There are many other improvements you can make to save energy, such as weather-stripping and caulking. A small investment now will soon pay for itself in reduced heating bills.

For more details on insulation and how to install it, pick up a free copy of the Federal Government's booklet, "Keeping The Heat In". Call toll free from anywhere in Ontario, Enersave Heat Line 1-800-267-9563. For information on the Canadian Home Insulation Program (CHIP) grant, call at 1-800-268-1818 (Toronto residents call 789-0581) or write to CHIP, P.O. Box 1270, Station T, Toronto, Ontario, M6B 4A4.

Remember, heat pump systems and insulation materials are exempt from federal and provincial sales taxes.



# How to go about it?

## What to do next

Each homeowner should ask these questions:

1. Am I interested in reducing my heating expenses?
2. Have I been considering installing a central air conditioner?
3. Am I considering replacing my existing heating system?

If 'yes', contact your local hydro office and enquire about a HEAT PUMP.

## Choose your contractor

Once you've decided on a heat pump system you will need a good contractor. Call your local hydro office or check the yellow pages for the names of heat pump manufacturers to obtain the name of a qualified installer.

The heat pump contractor should be able to give you a complete estimate for the installation of a heat pump.

It's wise to obtain several estimates. Remember, a unit incorrectly sized or improperly installed will waste money.

Make sure the contractor has done the following in preparing his estimate:

1. Produced or examined a "Heat Loss/Heat Gain" calculation for your house or determined heating requirements from past oil consumption. It will determine the size of the heat pump you need to heat and cool your house efficiently. Ask to see it.
2. Measured and examined the existing heating duct system to see if it is adequate. (A heat pump requires a larger air flow than conventional systems.)
3. Examined the existing furnace, if you are installing an add-on heat pump, to ensure that the heat exchanger is in good condition.
4. Examined the existing electrical service to determine whether upgrading is required and what it will cost.
5. Made you aware of the technical aspects of his proposed heating system and what you as the owner need to know in order to operate the system properly.
6. Discussed "Form A" and service arrangements with you. A reputable dealer will offer guaranteed maintenance contracts.
7. Obtained your signature on form "A".

A HEAT PUMP is an investment today, for the future. Use your energy wisely.

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your hydro 